NON-PUBLIC?: N
ACCESSION #: 9501190176
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Diablo Canyon Unit 1 PAGE: 1 OF 8

DOCKET NUMBER: 05000275

TITLE: Reactor Trip Due to Reactor Coolant Pump Bus Undervoltage
that Resulted from an Electrical System Disturbance
External to the PG&E System
EVENT DATE: 12/14/94 LER #: 94-020-00 REPORT DATE: 01/13/95

OTHER FACILITIES INVOLVED: Diablo Canyon Unit 2 DOCKET NO: 05000323

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
10CFR50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: David P. Sisk-Senior Regulatory TELEPHONE: (805) 545-4420
Compliance Engineer

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 14, 1994, at 0026 PST, with Unit 1 and Unit 2 in Mode 1 (Power Operation) at 100 percent power, both units experienced reactor trips. Both units were stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A four-hour, non-emergency report was made at 0131 PST in accordance with 10 CFR 50.72(b)(2)(ii).

The reactor trips were due to an undervoltage on the auxiliary power bus that provides power to the reactor coolant pumps. The undervoltage condition was due to a system disturbance external to the PG&E system.

Due to the circumstances of the event, no corrective actions were deemed necessary. However, the Western System Coordinating Council, a utility coordination group composed of the eleven western states and British

Columbia that are interconnected through the 500 kV Pacific Intertie, will study the transient and a formal report should be available in several months. If PG&E determines that any corrective actions are necessary as a result of this final report, a supplement to this LER will be issued.

END OF ABSTRACT

I. Plant Conditions

Unit 1 and Unit 2 were in Mode 1 (Power Operation) at 100 percent power.

II. Description of Problem

A. Summary

On December 14, 1994, at 0026 PST, with Unit 1 and Unit 2 in Mode 1 at 100 percent power, both units experienced reactor trips AB!RCT! due to a 12 kV auxiliary power system (reactor coolant pump (RCP) AB!P! feeder bus EA!BU!) undervoltage. The units were stabilized in Mode 3 (Hot Standby) in accordance with plant emergency procedures. A four-hour, non-emergency report was made at 0131 PST in accordance with 10 CFR 50.72(b)(2)(ii).

B. Background

PG&E has transmission systems operating at several voltage levels. The Diablo Canyon Power Plant (DCPP) is connected to the 230 kV system FK! for startup and standby power and to the 500 kV system FK! for transmission of the plant's power output. The 500 kV system is further connected through the 500 kV Pacific Intertie to the Western Systems Coordinating Council (WSCC) network covering the eleven western states plus British Columbia.

The DCPP electrical systems generate and transmit power to the high-voltage (500 kV) system, distribute power to the auxiliary loads, and provide control, protection, instrumentation, and annunciation power supplies for the units.

FSAR Update Section 1 5.3.4, "Complete Loss of Forced Reactor Coolant Flow," states that a reactor trip on RCP bus

undervoltage is provided to protect against conditions that can cause a loss of voltage to all RCPs, i.e., loss of offsite power. In addition, a reactor trip on low primary coolant loop flow is provided to protect against loss-of-flow conditions that affect only one RCP and also serves as a backup to the undervoltage trip.

C. Event Description

On December 14, 1994, prior to 0026 PST, the PG&E 500 kV system configuration was normal, except for one section of 500 kV line that had its backup relays in service (the primary relays were out-of-service for testing). At 0026 PST a 500 kV network fault and system separation occurred in

Idaho. The fault/separation voltage surge affected Nevada, Arizona, Southern California, and Northern California.

On December 14, 1994, at 0026 PST, with Unit 1 and Unit 2 in Mode 1 (Power Operation) at 100 percent power, both units experienced reactor trips due to RCP bus feeder undervoltage. Licensed plant operators in the control room NA! responded in accordance with established emergency procedures, confirmed the reactor trip, verified proper engineered safety features (ESF) actuations, and initiated manual actions to stabilize the units in Mode 3 (Hot Standby). At this time, the instrument AC uninterruptable power supply common trouble alarm annunciated.

At approximately 0027 PST, a unit trip automatically initiated and all 12 and 4 kV buses, except 4 kV vital Bus 1-F, transferred to startup power. Vital Bus 1-F was paralleled to both the auxiliary power system and its associated diesel generator (DG 1-3)EK!DG! for routine surveillance testing at the time of the event, and upon receipt of the automatic bus transfer signal, DG 1-3 picked up the bus load as per design (i.e., auxiliary power breaker opened). At approximately the same time, DG 1-1 and 2-2 started automatically, and, per design, all containment fan cooler units (CFCU), except CFCU 1-5, started.

In response to the reactor trip, both units experienced reactor coolant system temperature decreases. A centrifugal charging

pump was started for Unit 1 and the turbine-driven auxiliary feedwater (AFW) pumps BA!TRB!P! were throttled for both units. The RCS temperature recovered following these activities. Unit 1 reached 520 degrees F prior to recovery and Unit 2 reached 525 degrees F prior to recovery.

At approximately 0100, a manual transfer of vital Bus 1-F to startup power was attempted. During the manual transfer to startup power, the DG 1-3 tripped on phase-A overcurrent and DG 1-3 was declared inoperable.

Also, at approximately 0100, Unit 1 normal letdown could not be reestablished due to the failure of valve 1-LCV-460 to open, and excess letdown was placed in service.

In addition, at approximately 0100, a loss of vacuum was experienced on Unit 1. The condenser air ejectors were realigned and the condenser vacuum pump was started.

A four-hour, non-emergency report was made at 0131 PST in accordance with 10 CFR 50.72(b)(2)(ii).

At 0345 PST, excess letdown was removed from service and normal letdown was re-established.

At 0428 PST, due to continuing decreasing condenser vacuum, the Unit 1 main steam isolation valves were shut and the vacuum was broken.

D. Inoperable Structures, Components, or Systems that Contributed to the Event

Prior to the system disturbance, the PG&E 500 kV system configuration was normal, except for one section of 500 kV that had its backup relays in service (the primary relays were out-of-service for testing).

E. Dates and Approximate Times for Major Occurrences

1. December 14, 1994, at 0026 PST: Event/Discovery Date:

Automatic unit trip

initiated following 500
kV system disturbance.

2. December 14, 1994, at 0131 PST: A four-hour, non-emergency report was made to the NRC in accordance with 10CFR50.72(b)(2)(ii).

F. Other Systems or Secondary Functions Affected

1 . Diesel Generator 1-3

DG 1-3 testing was in progress at the time of the reactor trip. After the reactor trip, DG 1-3 was observed to be providing power to Bus F. During the manual attempt to transfer Bus F to startup power, an A-phase overcurrent tripped the feeder breaker. The cause of the overcurrent trip is being investigated and if any valid failures are identified, a separate special report will be submitted.

2. Letdown Isolation

Letdown isolated as required, but 1-LCV-460 could not be re-opened. Excess letdown was placed in service until the failure to re-open 1-LCV-460 could be investigated. The valve was subsequently opened using the control board switch following operators exercising valve position switches locally at the valve. The position switches were adjusted and the valve tested satisfactorily.

3. Loss of Vacuum

A loss of vacuum was experienced on Unit 1 approximately 30 minutes into the event. The air ejectors were realigned and the

NASH vacuum pump was started. Subsequent investigation determined that there was leakage through two moisture separator heater relief valves. The open relief valves were successfully reseated prior to returning Unit 1 to power operations.

4. Instrument AC Uninterruptable Power Supply Trouble Alarm

Instrument AC uninterruptable power supply 2-2 experienced a failed AC input. The failure was due to a previously documented rectifier control board sensitivity to voltage transients. The rectifier, as an equipment protection design feature, shuts down during voltage transients of 30 percent below and 20 percent above nominal. To reset the control board, the ac input breaker was cycled open and closed.

G. Method of Discovery

The event was immediately apparent to plant operators due to alarms and indications received in the control room.

H. Operator Actions

Licensed plant operators in the control room responded in accordance with established emergency procedures, confirmed the reactor trip, verified proper ESF actuations, and initiated manual actions to stabilize the units in Mode 3.

Approximately 5 minutes after the trip, plant operators secured the turbine-driven AFW pump for each unit in accordance with Emergency Procedure EOP E-0.1, "Reactor Trip Response," in response to an RCS pressure and temperature decrease. This manual action was successful in stopping the cooldown and recovering the RCS pressure.

I. Safety System Responses

1. The reactor trip breakers (JC)(BKR) opened.

2. The main turbine TA!TRB! tripped (turbine stop valves closed).

3. The control rod drive mechanism AA!DRIV! allowed the control rods to drop into the core.

4. The motor-driven AFW pumps and the turbine-driven AFW pump started automatically and delivered water to all steam generators as required.

5. DGs 1-1 and 2-2, due to light bus loading conditions, started on momentary bus undervoltage but, by design, did not close on their 4 kV bus since startup power was available.

6. All CFCUs, except for CFCU 1-5, started as expected on transfer to startup power. An investigation determined that the low speed timing relay failed on CFCU 1-5. The relay was replaced and the CFCU tested satisfactorily.

III. Cause of the Problem

A. Immediate Cause

As a result of a transient on the 500 kV system, the Unit 1 and Unit 2 RCP feeder buses experienced undervoltage, resulting in the initiation of a reactor trip signal.

B. Root Cause

The event was due to a 500 kV system disturbance due to a transmission line fault external to the PG&E system.

IV. Analysis of the Event

A reactor trip from 100 percent power is a previously analyzed FSAR Update, Chapter 15, Condition 11 event. The reactor protection system (RPS) responded as designed and initiated a reactor trip on low RCP bus voltage. The units were stabilized in Mode 3. Due to the momentary nature of the transient, and the availability of the standby 230 kV system power supply, the RCPs remained in operation throughout the event.

At the time of the reactor trip, Unit 2 was operating with a known fuel defect. Prior to the unit trip, RCS dose equivalent iodine (DEI) activity was below 0.1 micro-curie/gram (uc/g). After the reactor trip, the RCS DEI activity peaked at 0.9 uc/g approximately 4 hours after shutdown. Subsequent samples taken after shutdown showed declining RCS DEI activity. The low value of the DEI spike and short duration indicates no further fuel degradation due to the trip. The conditions of the fuel and the absence of primary to secondary leakage supported restart of Unit 2 as soon as practical (i.e., the fuel condition was not viewed as a constraint). An

iodine spike is anticipated during restart, but it will not be as high as the spike after the trip. Therefore, the restart would not be expected to exceed the steady-state Technical Specification limit.

An engineering evaluation was performed with regard to the voltage transients experienced by the plant equipment. Based on the voltage plots recorded for Unit 2, a momentary overvoltage condition, lasting less than one second, was

experienced prior to the reactor trip. The magnitude of the overvoltage condition was found to be within industry standards for all potentially affected equipment.

Initial concerns were raised that the cooldown was higher than expected for both units. After a review of previous reactor trip data, PG&E determined that the plant cooldowns were consistent with several past unit trips. An investigation concluded that the cooldown was due to a combination of AFW flow and, to a lesser extent, to steam dump operation due to controls sensitivity (a cooldown factor above 543 degrees F only). In addition, Unit 1 experienced a larger cooldown because Unit 1 was aligned as the normal source for common unit auxiliary steam.

The health and safety of the public were not affected by these events.

V. Corrective Actions

A. Immediate Corrective Actions

Electrical equipment inspections were performed before allowing the plant to restart. No evidence of any adverse effects was found.

B. Corrective Actions to Prevent Recurrence

No corrective actions were deemed necessary since the RPS performed its intended function.

The WSCC will study the transient and a formal report should be available in several months. If PG&E determines that any

corrective actions are necessary as a result of this final report, then PG&E will submit a supplement to this LER.

In addition, as a prudent measure, PG&E is evaluating the RCS cooldown to determine if there are any lessons to be learned and whether operational enhancements can be made to provide better RCS temperature control during plant transients.

VI. Additional Information

A. Failed Components

None.

B. Previous LERs on Similar Problems

LER 1-87-004-00, "Reactor Trip on Low Reactor Coolant Pump Bus Voltage Due to a 500 kV System Disturbance." On March 15, 1987, with Unit 1 in Mode 1, a reactor trip occurred when an airplane crashed into the Diablo Canyon-Gates 500

kV transmission line approximately 50 miles from the plant site. At the time of the event, Unit 1 main generator voltage regulation was in manual control, awaiting adjustments. The root cause of the reactor trip was the inability of the unit to withstand a major 500 kV voltage transient with the main generator voltage regulation in manual control. Based on the circumstances of the event, no corrective actions were deemed necessary. For the present event, the voltage regulation was in automatic mode and the plant responded as expected to the external system disturbance. Therefore, lessons learned from the 1987 event could not have prevented the present event.

Pacific Gas and Electric Company
77 Beale Street Gregory M. Rueger
San Francisco, CA 94106 Senior Vice President and
415/973-4684 General Manager
Nuclear Power Generation

January 13, 1995

PG&E Letter DCL-95-007

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Licensee Event Report 1-94-020-00
Reactor Trip Due to Reactor Coolant Pump Bus Undervoltage That Resulted from an Electrical System Disturbance External to the PG&E System

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed Licensee Event Report concerning a reactor trip due to an undervoltage condition on the auxiliary power bus that provides power to the reactor coolant pumps. The undervoltage condition was due to a system disturbance external to the PG&E system.

This event did not adversely affect the health and safety of the public.

Sincerely,

Gregory M. Rueger

cc: Edward T. Baker
L. J. Callan
Kenneth E. Perkins
Mike Tschiltz
Diablo Distribution
INPO

Enclosure

DCO-94-TS-N061

1268S/KWR/2246

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